Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method ~~for predicting the failure of a component, the method~~ comprising:

obtaining a Finite Element Model (FEM) of a component;

analyzing said FEM to obtain stresses at nodes of said FEM;

~~identifying a subset of said nodes as significant nodes based on said stresses;~~

determining a Representative Volume Element (RVE) for at least one of said ~~significant~~ nodes;

~~developing an RVE~~ building a microstructure-based failure model for at least one said RVE and including the microstructure-based failure model in the RVE;

simulating a component life using at least one RVE microstructure-based failure model, said simulating producing a result related to said component life;

performing said simulating a plurality of times to produce results related to component life;

preparing statistics using said results; and

comparing said statistics to a one or more probability of failure (POF) criteria ~~to determine whether said performing predicted failure for said component~~.

2. (Currently Amended) The method of claim 1, wherein said microstructure-based failure ~~is due to~~ model comprises fatigue failure modeling information.

3. (Currently Amended) The method of claim 1, wherein each said ~~RVE~~ microstructure-based failure model comprises at least one random variable and wherein probabilistic methods are used to provide values for said at least one random variable.

4. (Currently Amended) The method of claim 1, wherein said simulating further comprises:

establishing an RVE life for each said RVE, and

using each said RVE life to produce ~~a~~ the result related to said component life.

5. (Currently Amended) The method of claim 1, said ~~developing~~ building comprising:

~~identifying~~ receiving information indicative of a selected material microstructure in said RVE; and

~~characterizing how damage interacts with said material microstructure to provide at least one damage mechanism;~~

~~creating~~ receiving pre-determined failure modeling information ~~a failure model~~ for said selected material microstructure, wherein the pre-determined failure modeling information includes modeling information for one or more damage mechanisms for the selected material microstructure.

~~based on said at least one damage mechanism, said creating comprising:~~

~~finding a sequence said at least one damage mechanism works to damage said material microstructure;~~

~~getting for each said at least one damage mechanism one of a group of models consisting of: a crack nucleation model, a short crack growth model, and a long crack growth model; and~~

~~linking said models to produce said RVE microstructure-based failure model based on information from said identifying, characterizing, and finding.~~

6. (Currently Amended) The method of claim 5, wherein said pre-determined failure modeling information for the selected material microstructure includes modeling information for

at least one mechanical characteristic of the selected material microstructure, and further includes modeling information for at least one bulk elastic material characteristic of the selected material microstructure. ~~said characterizing further comprising~~:

~~determining said material microstructure's mechanical characteristics; and~~

~~determining said material microstructure's bulk elastic material characteristics~~.

7. (Currently Amended) The method of claim 5, wherein said ~~finding~~ pre-determined failure modeling information comprises crack nucleation modeling information, short crack growth modeling information, and long crack growth modeling information. ~~comprises:~~

~~determining how many of said at least one damage mechanism are crack nucleation mechanisms;~~

~~determining how many of said at least one damage mechanism are short crack growth mechanisms;~~

~~determining how many of said at least one damage mechanism are long crack growth mechanisms; and~~

~~developing a strategy for linking said crack nucleation, short crack growth, and long crack growth mechanisms~~.

8. (Currently Amended) The method of claim 1, said simulating further comprising:

determining ~~and~~ an RVE life for each said RVE, said determining an RVE life comprising:

evaluating a statistically determined number of nucleation sites within said RVE utilizing probabilistic methods.

9. (Original) The method of claim 8, wherein said probabilistic methods comprise Monte Carlo (MC) methods.

10. (Currently Amended) The method of claim 1, ~~said identifying~~ further comprising:

identifying a subset of said nodes as significant nodes based on said stresses. ~~obtaining a statistical distribution of said stresses at said significant nodes and said simulating a component further comprising:~~

~~establishing an RVE life for each said RVE using probabilistic methods and said statistical distribution.~~

11. (Currently Amended) The method of claim 10, wherein identifying a subset of said nodes comprises obtaining a statistical distribution of said stresses at said nodes, an wherein said simulating a component further comprises establishing an RVE life for each RVE using probabilistic methods comprising ~~wherein said probabilistic methods comprise~~ Monte Carlo methods.

12. (Original) The method of claim 1, wherein said component has regions of similar geometric detail and said simulating further comprises adding a spatial correlation for said regions.

13. (Original) The method of claim 10, wherein said component has regions of similar geometric detail and said simulating further comprising adding a spatial correlation for said regions.

14. (Currently Amended) The method of claim 5, wherein said ~~RVE~~ microstructure-based failure model comprises random variables and wherein probabilistic methods are used to provide values for said random variables.

15. (Original) The method of claim 14, wherein said probabilistic methods rely upon simulation-based methods.

16. (Original) The method of claim 15, wherein said simulation-based methods are direct methods selected from a group consisting of: Monte Carlo (MC) methods, and importance sampling methods.

17. (Currently Amended) The method of claim 5, wherein said ~~getting comprises developing at least one of said group of model~~pre-determined failure modeling information includes crack nucleation modeling information, short crack growth modeling information, and long crack growth modeling information based on the one or more damage mechanisms for the selected material microstructure, and wherein said building comprises linking said crack nucleation modeling information, short crack growth modeling information, and long crack growth modeling information.

18. (Currently Amended) The method of claim 5, wherein said pre-determined failure modeling information includes crack nucleation modeling information based on at least one of the one or more damage mechanisms for the selected material microstructure, wherein the crack nucleation modeling information is indicative of a damage interaction with said selected material microstructure for said one or more damage mechanisms.~~wherein said getting further comprises:~~

~~identifying variables that are important in the description of each said at least one damage mechanism;~~

~~relating said variables that are important to one of a group of damage mechanisms consisting of: a crack nucleation mechanism, a short crack growth mechanism, and a long crack growth mechanism to form, respectively, one of a group of models consisting of: a crack nucleation model, a short crack growth model, and a long crack growth model; and~~

~~defining output from said one of a group of models.~~

19. – 31. (Cancelled)

32. (Original) A method of determining the orientation factor for a grain slip system of a material, the method comprising:

obtaining equations that relate a stress direction to a material's at least one potential slip system;

simulating a grain orientation of said material, said simulating comprising:

using probabilistic methods to generate a slip plane normal angle for each said at least one potential slip system,

inputting said normal angle into said equations to obtain a potential orientation factor for each said at least one potential slip system, and

selecting the least said potential orientation factor as a grain orientation factor for said grain orientation;

repeating said simulating for a defined number of grains and obtaining a plurality of grain orientation factors; and

creating a statistical distribution of said plurality of grain orientation factors to determine an orientation factor for said grain slip system.

33. (Original) The method of claim 32, said probabilistic methods comprising Monte Carlo methods.

34. (Original) The method of claim 32, said equations pertaining to titanium aluminide.

35. (Original) An apparatus for determining the orientation factor for a grain slip system of a material comprising:

a central processing unit (CPU);

an output device for displaying simulated fatigue results;

an input device for receiving input;

and a memory comprising:

instructions for receiving input;

instructions for simulating a grain orientation of said material, said simulating comprising:

relating a stress direction to each of material's at least one potential slip system with equations;

using probabilistic methods to generate a slip plane normal angle for each said at least one potential slip system;

inputting said normal angle into said equations to obtain a potential orientation factor for each said at least one potential slip system; and

selecting a least said potential orientation factor as a grain orientation factor for said grain orientation;

instructions for repeating said simulating for a defined number of grains and obtaining a plurality of grain orientation factors; and

instructions for creating a statistical distribution of said plurality of grain orientation factors to determine an orientation factor for said grain slip system.

36. (Original) The apparatus of claim 35, said probabilistic methods comprising Monte Carlo methods.

37. (Original) The apparatus of claim 35, said equations pertaining to titanium aluminide.

38. (New) The method of claim 5, wherein the one or more damage mechanisms include stress and fatigue.

39. (New) The method of claim 5, wherein receiving information indicative of a selected material microstructure in said RVE comprises receiving information indicative of a component material, and wherein the selected material microstructure is selected from a plurality of available material microstructures associated with the component material. .

40. (New) The method of claim 1, wherein said performing said simulating a plurality of times comprises performing said simulating a first time using a first selected material microstructure of a plurality of available material microstructures associated with at least one component material, and further comprises performing said simulating a second time using a second different selected material microstructure of the plurality of available microstructures associated with the at least one component material.

41. (New) An article comprising a machine-readable medium storing instructions operable to cause one or more machines to perform operations comprising:

receive information indicative of a component configuration of a component;

obtain a finite element model (FEM) information associated with the component;

analyze the FEM to obtain stresses at one or more nodes of the FEM;

determine at least one Representative Volume Element (RVE) for one or more associated nodes; and

simulate a first component life using at least one microstructure-based failure model for the at least one RVE based on a first selected microstructure of a plurality of available microstructures for the component to obtain a first output; and

simulate a second component life for the at least one RVE based on a second different selected microstructure of the plurality of available microstructures for the component to obtain a second output.

42. (New) The article of claim 41, wherein the instructions further comprise:

generate information indicative of a first component lifetime based on the first output; and

generate information indicative of a second component lifetime based on the second output.

43. (New) The article of claim 42, wherein the operations further comprise:

generate statistics using said information indicative of the first component lifetime and the second component lifetime.

44. (New) The article of claim 43, wherein the operations further comprise:

compare the statistics to information indicative of one or more probability of failure criteria.

45. (New) The article of claim 41, wherein the microstructure-based failure model for the RVE comprises fatigue failure modeling information.

46. (New) The article of claim 41, wherein the operations further comprise:

simulate a component life a plurality of times for each RVE to obtain information indicative of a RVE life for each RVE; and

using the information indicative of the RVE life for each RVE to generate statistics for each RVE; and

compare the statistics to information indicative of one or more probability of failure criteria.

47. (New) A system, comprising:

a processor;

an input device configured to receive input; and

one or more machine-readable media storing instructions operable to cause one or more machines to perform operations comprising:

receive information indicative of a component configuration of a component;

obtain a finite element model (FEM) information associated with the component;

analyze the FEM to obtain stresses at one or more nodes of the FEM;

determine at least one Representative Volume Element (RVE) for one or more associated nodes; and

simulate a first component life using at least one microstructure-based failure model for the at least one RVE based on a first selected microstructure of a plurality of available microstructures for the component to obtain a first output; and

simulate a second component life for the at least one RVE based on a second different selected microstructure of the plurality of available microstructures for the component to obtain a second output.

48. (New) The system of claim 47, wherein the instructions further comprise:

generate information indicative of a first component lifetime based on the first output; and

generate information indicative of a second component lifetime based on the second output.

49. (New) The system of claim 48, wherein the operations further comprise:

generate statistics using said information indicative of the first component lifetime and the second component lifetime.

50. (New) The system of claim 49, wherein the operations further comprise:

compare the statistics to information indicative of one or more probability of failure criteria.

51. (New) The system of claim 47, wherein the microstructure-based failure model for the RVE comprises fatigue failure modeling information.

52. (New) The system of claim 47, wherein the operations further comprise:

simulate a component life a plurality of times for each RVE to obtain information indicative of a RVE life for each RVE; and

using the information indicative of the RVE life for each RVE to generate statistics for each RVE; and

compare the statistics to information indicative of one or more probability of failure criteria.